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So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues published and those which are not now available is given for reference. Attention is especially directed to Volume 7 which had only one part:—

Vol.			*Vol.*		
1.	3 numbers,	1928.	11.	4 numbers,	1940 (none).
2.	4 „	1929.	12.	4 „	1941 (none of Nos. 1 and 2).
3.	3 „	1930 (none).			
4.	4 „	1931.	13.	4 „	1942.
5.	2 „	1932 (none of No. 2).	14.	4 „	1943.
6.	2 „	1933.	15.	4 „	1944.
7.	1 „	1934.	16.	4 „	1945.
8.	4 „	1935–37 (none of No. 4).	17.	4 „	1946 (none of No. 1).
9.	4 „	1938 (none of Nos. 2, 3 and 4).	18.	4 „	1947 (none of No. 1).
			19.	4 „	1948 (Nos. 3 & 4 form a double issue.)
10.	4 „	1939 (none of Nos. 2 and 4).			

ISSUES OF THE AGRICULTURAL CIRCULAR.

NUMBERS and year of issue of the *Agricultural Circular* :—

Vol. 1,	1920,	12 numbers.	Vol. 4,	1923,	1 number.
2,	1921,	5 „	5,	1924–5,	2 numbers.
3,	1922,	4 „			

As number 4 of Vol. 3 was printed as " Volume 4 " and number 1 of Vol. 4 as " Volume 5 " it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, No. 1.

ANNUAL BULLETINS.

THE Annual Bulletin of Divisional Reports ran from 1931 to 1938 and was then discontinued.

OLD ISSUES OF AGRICULTURAL BULLETINS.

FREE copies of the following Bulletins are available to Colonial Departments of Agriculture research institutes and bona fide planters within the Colony.

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4. The Banana in Fiji, 1912.
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Applications should be made to the Librarian, Department of Agriculture, Suva, Fiji.

—EDITOR.

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EDITORIAL . . .

THE USE OF INSECTICIDES

A striking feature of agriculture in Fiji is the failure of farmers to make use of simple and well tried methods of controlling insect pests by the use of insecticides. The economic loss to growers due to their failure to use insecticides must reach a staggering total, which can only be guessed at. It is abundantly clear that farmers can never enjoy the full fruits of their labour until the use of insecticides becomes standard practice.

To realize the full force of this statement, one has only to see what happens in local rice-fields during an outbreak of armyworms. Often such an outbreak occurs when the crop is in ear, and the grain in the milk stage. Armyworms ascend the stalks, and nip off the spikelets of grain, great numbers of which fall to the ground. When the farmer sees this happening, he hastens to harvest the crop, thus obviously including a great deal of pinched grain in the harvest. Hence he has lost not only the grains nipped off by the armyworms, but a great weight of grain sacrificed by reaping an immature crop. The average production of padi per acre in Fiji is about 14 cwt., valued at £15, and quite a large percentage of this must be lost during a bad armyworm year. Yet the farmers make no attempt to implement even such a simple measure of control as broadcasting a poisoned bait, the materials for which would cost about 5s. per acre.

An even more striking example, though with a much less important crop than rice, is to be found in the case of losses caused by the attacks of leaf-eating caterpillars on cabbage. A very conservative estimate of the value of cabbages at existing prices which could be produced per acre is £500. Even though hand-collection of caterpillars is carried out, it is not uncommon for half the crop to be lost. Here we see a loss of £250, which could be almost entirely averted by dusting or spraying with materials costing perhaps £2 per acre.

There are many other examples of insec losses which could be avoided or greatly minimised by the routine use of well known control measures. Among these are control of Banana Scab Moth (some attempt at regular control by dusting is made here), Fruit-flies and Dalo Leafhopper. The cost of the insecticides is small, and they can be applied with inexpensive applicators. Hence it is evident that the time is long overdue for local growers to take appropriate action. Details of the nature, cost and source of supply of insecticides and applicators may be obtained from the Department of Agriculture.

During the last ten years, methods of control of insect pests have undergone a great change; due to the development of modern organic insecticide such as DDT, Gammexane, Chlordane, Tetraethyl pyrophosphate and Hexaethyl tetraphosphate. Some remarks on various insecticides and applicators are appended:—

DDT Dispersible Powder (50 per cent p-p'-isomer).—This is a very useful general purpose formulation, designed to be made up into a spray. For control of a wide range of agricultural pests, such as cabbage grubs, taro leafhopper, rose-beetle, and many other chewing and sucking insects, one pound of the powder is mixed with 50 gallons of water. The spray deposit quickly dries on plant foilage, and resists considerable washing by rain. For depositing a residual spray on the walls of houses, dairies, stables, etc., one pound of the powder is mixed with ten gallons of water, and leaves a deposit which is lethal to flies and mosquitoes for several months.

DDT Agricultural Dust (2 per cent p-p'-isomer) is effective against much the same range of plant pests as are controlled by the Dispersible Powder spray, and may be used when dusting is preferred to spraying. This dust is effective also in controlling Scab Moth on bananas, and is cheaper than the usual pyrethrum mixture.

White Spraying Oil is used for control of Scale insects and Mealybugs. One part of the oil is mixed with forty parts of water to produce the finished spray.

Tetraethyl pyrophosphate (TEPP) *and Hexaethyl tetraphosphate* (HETP).—These compounds have largely replaced Nicotine Sulphate for control of aphids, and they are effective also against thrips and mites and in foliage baits for fruit flies. They are used as a spray in very great dilution, from one part to 1,000 and upwards of water, and kill by contact. These compounds are very poisonous, and must be handled with care. They break down rapidly when mixed with water, and thus leave no toxic deposit.

Chlordane emulsion is a very satisfactory specific for ants in houses and seed-beds. When diluted to 1 in 1,000 with water and sprayed freely on the nests of ground-nesting ants, it achieves practically a complete kill, and has a good lasting effect.

Paris Green.—Mixed with molasses and rice bran or sawdust and water, this highly poisonous substance is effective as a bait for armyworms and cutworms. Laboratory experiments indicate that DDT dispersible powder may prove a less dangerous substitute for Paris Green.

There are, of course, many other types of insecticide which are effective against merely a selection of commonly used material which will cope with most insect pests.

Turning to the appliances for dispensing insecticides, there is a wide range of machines in general use, and a selection may be used in accordance with the needs of the individual. Small hand dusters, suitable for amateur gardeners, may be obtained at a cost of a few shillings, somewhat larger types for about £2, and rotary or knapsack dusters, suitable for treating several acres of crop, for less than £10. There is a similar range of spraying machines from atomisers to knapsack and pneumatic sprayers, prices ranging from about 30s. to £10.

In choosing between spraying and dusting as a means of applying insecticides, the following factors should be considered. Dust tends to be washed off by rain, whereas a spray deposit, when it dries on the foliage, is resistant to washing. This is particularly important when a lasting effect is desired. On the other hand, dusts are quick and easy to apply, and give good coverage with little effort. When a considerable area of crop is to be treated, dusts avoid the necessity for handling and transporting large quantities of water, and thus, provided that they give an efficient kill, would be preferred to sprays. Cost of materials is much the same, with dusts perhaps a little more expensive than sprays.

A great difficulty in the path of a potential user of insecticides in Fiji is that, apart from a few odd articles sold in pharmacies, the local stores do not keep stocks of insecticides and applicators. It is evidently considered that there is no profitable business to be done in this direction, although in other countries a section of the hardware department usually handles these lines of merchandise. It is to be hoped that this attitude will change, but in the meantime interested persons may obtain from the Agricultural Department addresses of firms from whom appropriate insectcides and applicators may be imported.

—B.A.O'C.

AGRICULTURAL SCHOLARS

Both the holders of the Government scholarships to Gatton Agricultural College, Queensland, have completed their course of studies and have qualified for the Diploma of Agriculture, Queensland. They are both Fijians—William Toganivalu and Eminoni Raivoka—and were appointed to the staff as Field Assistants as from 8th April, 1949, and stationed at Naduruloulou.

A third Fijian student, Aisake D. Naigulevu, who has been studying privately at Massey Agricultural College, New Zealand, also completed his studies during 1948 and was awarded the Diploma of Agriculture of that College. He was appointed to the staff with effect from 8th February, 1949.

—M.C D.

AGRICULTURE . . .

REPASTURING A DAIRY FARM IN THE NAVUA DISTRICT

BY R. P. LITTLE

In our Editorial of January 1948 (*Agric. Journ. Vol.* 19 *No.* 1) *we drew attention to problems of livestock nutrition in the tropics and made reference to work being conducted on a commercial dairy undertaking at Navua. The present article deals more particularly with the problems of rehabilitation and repasturing and makes reference to the results achieved by subdivision, grass management by rotational grazing and weed control by mowing.*

The area of this particular farm is 106 acres. The land is flat though there is a slight fall from the Navua River bank to its eastern boundary some 44 chains distant. The fall would not exceed six feet; it is hardly perceptible though found to be very real when constructing drains.

The reason for complete repasturing of this farm is a simple one. During the late war little labour was available for pastures and drains maintenance, consequently pastures had deteriorated from lack of such imperative work. The dairy herd had been maintained as numerically strong as in past years when the farm was well maintained and well grassed. The result, an obvious one: pugged pastures, lack of drainage, recession of edible grasses, the incursion of noxious weeds which abound in this district. The damage was done—walk out of the farm or rehabilitate it; naturally the latter course was the only one to take.

The average rainfall in this district is 150 inches; unlike most tropical lands there is no definite wet or dry season. A search of rainfall records over the past 20 years reveals less continuous rain from September to November inclusive; even so, the average days of rain recorded was 19, the longest period without rain ten days. This is not a pleasant picture from the point of view of economical cultivation, the successful elimination of stubborn noxious weeds and the working up of a desirable tilth necessary to re-establish Para, (1) which was the grass decided upon.

After weeks of continual observation it was decided to close the farm to stock, open main drains, lift subdivisional fences (retaining boundary fences only), construct a metal road with deep drains on both sides, double fenced, dividing this portion of the farm into two equal sections of 44 x 11 chains, equal to approximately 96 acres. From this central road dairy stock would, when pastures were rehabilitated, be routed to the small 5-acre paddocks left and right of the road. A well maintained central road eliminates pugging of pastures and is less exhausting to dairy stock.

With the main drains constructed the result was more immediate than expected. Within a month we were able to use a tractor with a heavy 28-inch disc-plough, four-furrows, ploughing an average depth of 12 inches. The structure of the soil appeared excellent, the cover crop, Hibiscus Burr,(2) Tar Weed,(3) Primrose Flower,(4) the tall water "Sedge,"(5) and a more vicious "Sedge" species unknown. A conservative estimate of same would be approximately 10 tons per acre; this proved valuable organic manure which in this wet, hot climate was quickly incorporated into the soil giving us friability and aid in the working up of a fine tilth necessary to the reception and maximum strike of Para.

The whole farm was ploughed and cross-ploughed with the 28-inch disc-plough, it was then ploughed and cross-ploughed with a Sundercut plough with alternating discs 22-inch and 18-inch. August of that year was very wet, nothing could be done with the plough. In early September drier weather set in and no time was lost in getting

(1) *Brachiaria mutica.*
(2) *Urena lobata* var. *scabriuscula.*
(3) *Cuphea carthaginensis* (Jacq.) Macbr.
(4) *Jussiæa* spp.
(5) *Cyperus* spp.

the Sundercut light plough to work, ploughing in a wealth of freshly germinated noxious weeds, principally Tar Weed, and adding splendidly to the tilth structure of the soil. With this work complete, the light disc harrows were used; this is a very economical implement, a light tractor can deal with 15 acres in a day of eight hours at an all-in cost of 30s. It has been our experience that you must have your ploughed land as clean, and with a similar tilth, as a wheat field if you hope to get maximum success with Para.

In mid-October we commenced planting Para. The method of planting was to cut and transport by lorries, spread the Para on the newly cultivated land, plough in with the Sundercut plough with the intermediate 18-inch discs removed, depth of ploughing 12-inch. With the Para spread on the field a tractor with this plough can plant an acre an hour.

By late December the last paddock was planted. Divisional fences were erected, sited along the borders of the lateral drains. These drains were constructed at 4½ chains interval and discharged into the main drain on each side of the new road. This gave us nine paddocks of approximately 4½ x 11 chains south and north of the new road, a total of 18 paddocks of approximately five acres each. Gates and causeways were put in. We awaited the day when the Para would be advanced to a stage in growth which would permit re-stocking with safety. On the western side of the Government road there are two paddocks of approximately 6½ acres; these were of course repastured.

The farm was closed to butterfat production early in June and reopened to production early in January the following year. No manures were used other than the organic cover crop.

What of the cost of this work in relation to production? The bare cost of ploughing, cutting and transport of Para, the planting of same, fuel and grease for the tractor (but not benzine used by lorries in the transportation of Para) was £4 12s. 3d. per acre. A conservative estimate of depreciation of plant and benzine used by lorries would be approximately 6s. per acre, bringing the total to £4 18s. 3d. per acre. The new road, 44 chains long 12 feet wide, £73 12s. 0d., drains four miles three chains, £240 11s. 0d. fences three miles 33 chains at £78 per mile, £266 10s. 0d., a total cost of £889 9s. 6d. The new fences are two-barbed wire for divisional fences running along lateral drains.

The surface quality of the new road is equal to the surface of a Government feeder-road; this may appear a luxury to many dairy farmers but it is not when you consider that it requires 2¾ tons of Para to plant an acre, or a total of 306 tons for the whole farm. Without this road we would have had to use bullocks and sledge, a slow and costly work. With the road, our lorries could haul Para to each individual paddock. With planting complete, we still have our road for routing dairy stock with comfort and speed.

There is a credit side to the overall expense of £889 9s. 6d. There had been no maintenance to drains, or fences, for several years past. Drains were completely healed over, divisional fences cut here and there to allow stock freedom of movement from pugged conditions; the result, an ever-increasing width of ruined pastures by moving stock. Something had to be done; it is possible that a simple job of maintenance to fences and drains would have cost some 50 per cent of the new work. I must point out that we were bringing into being rotational grazing, without which pastures are short-lived.

We have a farm well-drained, well-fenced, well-pastured. The farm has been in butterfat production for a period of two years; during this time no maintenance has been necessary other than the weeding of drains, and stock are in good heart. The drains have been weeded twice at a ridiculously low cost, in no case have the drains been damaged by stock, thanks to border fences.

From a comparison point of view in butterfat production, before and after the rehabilitation of this farm, we quote the year ended 30th June, 1947, and 30th June, 1949.

Average production per cow—
1947—164.3 lb butterfat.
1949—214.8 lb butterfat.

The difference is 50.5 lb butterfat per cow. The mean average of cows in milk for the two years quoted above was 67, therefore the gross increase in butterfat was 3,383.5 lb, equal to a return of £380 12s. 10d. with butterfat at 2s. 3d. per lb. These figures are based on butterfat weights received at the factory. The herd which occupied this farm was transferred in its entirety to another farm during the period of rehabilitation, then transferred back in a similar manner. Before closing the farm the herd received supplementary feeding; this was abandoned on their return.

CONCLUSIONS.

Butterfat production on this farm had declined from 208 lb per cow to 164 lb. It is highly probable that the decline would have continued. The actual figure we must consider is the increase in a year of 3,383.5 lb butterfat, equal to £380 12s. 10d., this in a year of continual rain. It is a good investment which shows a profit of £380 12s. 10d. for an outlay of £889 9s. 6d. We still have our fences, our drains, and our new road. Cows are in good heart.

The writer is a farmer who loves soil and stock. He has no academic qualifications in agriculture. What has been accomplished with this farm is the result of observation of soil and grasses, hard work, careful planning, and the knowledge gained by an intensive course of 19 days at Massey College, New Zealand, where rotational grazing is a fine art.

There are many disappointments, and frustrations, in cultivating land in the wet zone of this Colony; such can be endured when considering successes gained.

STAFF NOTES

Mr. T. L. Mune, Livestock Officer, was transferred to the Education Department as Farm Manager, Queen Victoria School and Ratu Edward Kadavulevu School, with effect from 1st July, 1949.

Miss M. W. Green returned to the Department as Temporary Clerk with effect from 6th July, 1949.

Mr. B. E. V. Parham, Senior Agricultural Officer, departed on vacation leave to the United Kingdom with effect from the 9th July, 1949. On his way to the United Kingdom Mr. Parham represented the South Pacific Commission at the United Nations Conference on Conservation and Utilization of Resources, held at Lake Success, U.S.A. Prior to this he was occupied whilst at Vancouver with investigations into the handling and marketing of Fiji bananas in Canada.

Mr. M. D. ffrench-Mullen was appointed to act as Senior Agricultural Officer from that date.

Mr. H. T. B. Hall, Veterinary Officer, went on leave prior to transfer as Deputy Director of Agriculture (Veterinary Service), Jamaica, with effect from 10th July, 1949.

Mr. W. Gordon, Agricultural Assistant, was promoted to be Farm Manager with effect from 1st July, 1949.

Mr. C. E. Whitehead, Farm Manager was promoted to be Soil Conservation Officer with effect from 20th June, 1949.

Mr. S. Ramjan, Field Assistant, was promoted to be Assistant Soil Conservation Officer with effect from 1st July, 1949.

TAPIOCA STARCH MILL

The opening ceremony of the Fijian Co-operative Market Association's new tapioca starch mill took place at Nausori on the 21st January 1949, the Colonial Secretary (Mr. J. F. Nicoll, C.M.G.), being the Principal guest. After a full Fijian ceremonial welcome and an address of welcome given by Manasa Tauca, B.E.M., the Managing Director of the F.C.M.A., the Colonial Secretary spoke. The distinguished guests were entertained at tea, during which a vakamalolo was performed, while later the designer of the plant, Mr. G. Cederman of New Zealand, demonstrated its working. It is particularly pleasing to be able to congratulate a Fijian concern like the F.C.M.A. on being first in the field with its factory, which produces tapioca starch of excellent quality.

—M.C.D

ANIMAL HUSBANDRY . . .

THE ACCLIMATIZATION OF EUROPEAN BREEDS OF CATTLE IN THE TROPICS

BY C. R. TURBET

There has been much written in regard to the supposed failure to become acclimatized of European breeds of cattle in the tropics. As a result, some, including well known authorities, have advocated that no further attempts should be made to improve cattle in the tropics by importation of European breeds. Instead, building up the indigenous cattle of the tropics to increase their milk yield by selection and culling has been advanced as the best means of improving the milk supply in tropical countries.

In Fiji, since there are no indigenous cattle there is no alternative to the introduction of cattle. Because of the nearness of Australia and New Zealand most cattle imported are of the European breeds. A few Zebus of the Nellore breed were imported from India some 40 years ago, some animals of doubtful breeding from Australia and a useful number of pure bred Nellores (called Brahman in the U.S.A.) were imported from Texas in 1938. All of these animals have done well. As far as the production of milk is concerned the imported European breeds yield in Fiji on the average more milk than do the indigenous cattle of other tropical areas.

Whilst it is agreed that every effort should be made to improve indigenous breeds of cattle, the process is so slow when applied to vast numbers of cattle covering a wide area and with so many diverse human influences that little practical result in the way of widespread increase in the milk yield of the general cow population is to be expected in the lifetime of man except through the influence of imported cattle.

There is no doubt but that there are factors existing in many tropical countries which may and do limit the chances of successful acclimatization of European breeds of animals. These factors come under the headings of (*a*) climatic conditions, (*b*) the incidence of acute infectious diseases, (*c*) nutrition, and (*d*) management. It is proposed to discuss these and to endeavour to point out the means by which the adverse influences of these factors may be lessened.

CLIMATIC CONDITIONS.

European animals, including cattle and man, have proved themselves capable of existing and even thriving under conditions of considerable variation in climatic conditions where not exposed to the adverse conditions imposed by infectious disease, malnutrition and bad management. It has been stated[1] " It cannot be too strongly emphasized that European cattle suffer from certain grave disabilities in a tropical environment which render them quite unsuitable for milk production except in very limited areas and very specialized conditions of management." One is forced to the conclusion that Wright's statement overemphasizes the seriousness of the disabilities occasioned as a result of tropical climate. In coming to the conclusion which he reached it appears that he has grouped all the disadvantages of disease, malnutrition and bad management under " tropical environment," which is correct, but environment even in the tropics can be varied at the will of man. In certain tropical islands of the Pacific, i.e. Fiji, Hawaii, where acute infectious diseases do not occur, where nutrition is on a fair plane and where management is reasonably good, there are large numbers of cattle composed mainly of European breeds engaged in the dairy industry. These animals breed regularly reach maturity at the same age as do cattle in temperate countries and grow to the same size.

It is true that long exposure to the sun, excessive exertion in the heat of the day and inadequate provision for body ventilation so that heat radiation may occur, are

all unfavourable to the well-being of European cattle. The same factors apply however to cattle and animals of any breed to a greater or lesser extent.

It is known however that even among the European breeds variation exists in their heat tolerance and their ability to stand up to tropical conditions. There is evidence to show that the skin of Jersey cattle is better adapted than that of other cattle. Whole red or whole black skinned cattle also do better than those with white or unpigmented areas. Cattle with white areas on the back are in fact much troubled with photosensitization or sunburn and many develop the so-called skin cancer. It will be seen therefore that in selecting European breeds of cattle for introduction into the tropics the above-mentioned factors must be taken into cosideration.

One must admit also that their milk yield does not reach the same level as would the same cows under dairying conditions of temperate countries. This fact I attribute to the general effects of tropical environment. Nevertheless production figures in Fiji show that the average yield is three-fifths of what the same cow would produce under the dairying conditions extant in temperate climates. In other words a five-gallon cow in New Zealand would produce three gallons in Fiji. This must be admitted to be a reasonable and profitable yield.

It has been proved conclusively in Fiji that European breeds of cattle are more profitable to keep on dairy farms than the Indian breed Nellore which is well represented there. Practically none of these as pure bred cattle, are to be seen in daries, whilst Nellore crossed with European cows are not now commonly seen in commercial dairies, although they are common in the herds of peasant farmers. This fact indicates a distinct preference on the part of commercial dairy farmers for European breeds of cows for tropical dairy farming.

YIELDS OF DAIRY CATTLE IN FIJI.

In Fiji, which is in the wet tropics at 18° south latitude, dairy farming is carried on at sea level. The average annual rainfall is 116 inches which is distributed over every month of the year, the wettest months being November to March. Temperatures range from 55°F. to 93°F., the mean annual temperature being 76°F. Humidity is always high.

By courtesy of the Fiji Pastoral Company, the yields of butterfat for 1948 and of milk calculated on an average butterfat content of 3.7 per cent for Friesians and mixed herds and 5 per cent of Jerseys given in the following table:—

Breed.	Shed No.	No of cows.	Average butterfat.	Days in milk.	Average milk yield.
			lb.		lb.
Grade Friesians ..	1	74	125·1	252	3,381
Jersey and Friesian.	2	67	210·0	266	5,675
Grade Jerseys ..	3	71	253·4	230	5,068
Poll Friesian ..	4	88	142·2	248	3,843
Jersey and Friesian.	5	55	132·7	243	3,586
Grade Friesian ..	6	78	194·6	275	5,259
Grade Friesian ..	7	62	162·3	278	4,432
Jersey and Friesian.	8	70	219·9	292	5,930
Grade Friesian ..	9	43	165·0	283	4,459
Selected Friesian ..	10	67	195·3	308	5,278
Jersey and Friesian.	11	52	135·8	271	3,670
Jersey and Friesian.	12	30	153·4	235	4,146
Grade Friesian ..	13	80	115·3	215	3,116
Totals ..	..	837	169·5	257	4,581

It will be seen that this figure for butterfat compares very well with that given by Rice(2) for the average production of recorded grade cows in Queensland in 1945–46 which was 160 lb.

CATTLE WEIGHTS.

As an indication of the size to which cattle grow in Fiji the average dressed weight of the carcases of all cattle killed in registered slaughter houses in Fiji for August 1949 was 507 lb. This figure is an average for bullockss, steers, cows and a few vealers. It will be seen therefore that the average for the bullocks is much higher than the figure given. In fact 600 lb dressed weight for four-year-old steers is an approximate average whilst the highest dressed weight recorded was 1,200 lb in the case of an aged bullock. It will be seen that these weights compare reasonably well with those of cattle raised and killed in temperate climates and serves

to show that as far as Fiji is concerned European breeds of cattle have already been acclimatized to the tropical conditions extant in the islands.

My conclusion in regard to the harmful effect of tropical climate, i.e. uniformly high temperature and humidity, is that these can be largely offset by good management.

INFLUENCE OF INFECTIOUS DISEASE.

There is ample evidence to show that the occurrence of infectious disease is a principal cause of failure of European cattle to become acclimatized and to thrive in the tropics. Such animals have little if any natural immunity to the infectious diseases met with in the tropics because of lack of association with these diseases in their home land.

As an illustration of the serious losses which might occur, it is recorded that up to 90 per cent of some lots of cattle exported from Europe to the southern States of the U.S.A. in the early days of settlement died soon after arrival as a result of tick fever.

In the same way a large proportion of the cattle imported into Ceylon from Australia during the war and which were subsequently depastured at Nuwara Eliya, Ambewela and Bopatalawa died of the same disease.

The tick fevers include *Piroplasmosia* and *Anaplasmosia*. Other devastating tropical diseases which may cause heavy mortality or failure to thrive are rinderpest and foot and mouth disease. Many cattle are thus subjected at the same time to both the rigours of acute disease and unfavourable tropical climate so that they have little chance of becoming profitable to their owners.

Tropical diseases, however, can be controlled and in some cases entirely eradicated so that this factor will cease to militate against the successful acclimatization of European breeds of cattle. It is not as easy in practice however as merely stating the fact. A veterinary service strong in numbers and talent is needed. It must be supported by sufficient funds, equipment and a well organized laboratory service for diagnosis research and for the preparation of vaccines and biological products.

MANAGEMENT.

Much can be done by good management to offset the adverse effects of tropical climate. Cows should not be exposed to the sun for long periods between mid-morning and mid-afternoon. They may be given protection by the shade of trees or houses. These should be well ventilated and erected on a site selected for maximum exposure to air currents and prevailing winds. Ample drinking water and succulent green feed should be provided. The roofs of cow houses where these are used should be of material which does not readily absorb heat, that is, fibro cement or thatch may be used but not iron sheeting unless this is covered with thatch or a ceiling inserted beneath it. The temperature underneath an iron roof may be greatly lowered if the iron is painted with calsic or aluminium paint. Furthermore cattle must be handled gently and not be driven vigorously during the heat of the day.

Under such conditions there is very little rise in the noonday temperature of cows. This has been demonstrated by the personal taking of large numbers of cows' temperatures at varying periods of the day in the performance of the tuberculin test by the subcutaneous injection—temperature reaction method which was used in Fiji for many years before the introduction of the various intradermal tests. On the other hand where cattle have not been given the protection described noonday rises of temperature up to three degrees are common and accompanied by increased respiration rate which adversely affects their general health and production.

In regard to the need for protection from monsoonal rains this is not so important in the warm tropics. Little, if any, harm results from exposure to warm monsoonal rain in tropical lowlands. The worst feature is the continuously wet state of the ground and the churning up of the soil into quagmires which invariably occurs on land to which large numbers of cattle have access. The problem is most serious in overstocked fields and in the vicinity of cattle sheds where cattle are driven in and out daily. Cattle depastured permanently in the open field do not suffer unduly from rain but

milking cows often undergo hardship owing to lack of rest under continuously wet and muddy conditions. The taking of proper steps to avoid subjecting milking cows to these hardships is most important in improving environmental conditions.

NUTRITION.

Although much has been done to improve the nutrition of cattle in tropical countries, it cannot be said that the science has reached the same high level as in temperate zones. The range of concentrate foodstuffs is smaller and there has been little attention paid to the improvement of pastures until comparatively recent times.

Natural pastures in the wet tropics are for the most part rank in growth and contain an excess of indigestible fibre. Such pastures may contain barely sufficient nutrients for maintenance and growth. Unfortunately in the past, guided by the experience in temperate countries that pasture is the perfect food for cattle, too much faith has been placed on the unimproved tropical pasture as a source of nourishment for imported cattle. The result has been that the cattle have fallen off in condition. Their susceptibility to disease has increased and in many cases sterility has resulted.

Earlier attempts to improve the quality of green food for cattle have been through the cultivation of fodder crops. By this means the nutritive value of the bulk ration has been so improved as to compare with the pasture of temperate zones. Fodder crops however are expensive to maintain and to feed so that their usefulness in economic cattle feeding is limited.

More recently serious attempts have been made in the tropics to improve the quality of pasture so that cattle may derive the bulk of their ration from grazing. In some countries considerable success has been attained. In Ceylon the position is complicated in the west and south-west by the large concentration of human population and the consequent necessity to devote nearly all the land to the growing of food crops for man. In the foothills and uplands plantation crops leave little room for the grazing of cattle. The result is that over a large area of well watered and fertile country in Ceylon cattle have not been given a chance to demonstrate their economic worth under a natural environment, which is grazing at pasture.

There is evidence that soils over large areas are deficient in lime and phosphorus. The result is that these elements are deficient in the pasture and fodder crops of the same areas. It is necessary therefore to provide the animals with minerals in their diet if the cattle are to be expected to thrive and to produce milk to their maximum capacity. Sodium chloride, or common salt, occurs in the body fluids in about nine parts per thousand by weight. It is lost from the body in sweat, in milk and other excretions so that the need for its replacement is obvious. There is usually a deficiency of common salt in the soil in the wet tropics in places away from the sea coast. The feeding of common salt in the concentrate ration is of first importance therefore in considering the mineral requirements of cattle. Some minerals are needed in very small quantities only. If not present in the food the animals do not thrive and may show obscure illness. These minerals are usually called "trace elements." A typical mineral mixture for cattle might therefore contain about 60 per cent of common salt; 38 per cent of sterilized bone meal, which itself contains about 56 per cent of phosphate of lime as well as sulphur and other minerals; 1 per cent of either sulphate or oxide of iron; 1½ per cent of copper sulphate and a little cobalt and iodine in the proportion of about one in one thousand.

CROSS-BRED CATTLE.

Apart from the use of pure bred cattle of European breeds for milk production in the tropics, it cannot be denied that a large part of the milk supply now available in the tropics is derived from cross-bred cattle, that is, European breeds crossed with Zebu or other indigenous cattle. The animals seem well adapted to their environment and are reasonably good producers. I have recommended elsewhere that the cross between the red Sindhi and the red polled breed is worth while. In fact, the red Sindhi or Sahiwal (Montgomery) breeds

might be crossed with any of the European breeds if milk production and improved constitution is the aim. If a large enough series of animals is secured as a result of the first cross, by culling and selection, within this group there is no scientific reason against the development of a new breed. The continued importation of cattle of European breeds is indicated, therefore, if only for the value of crossing with indigenous or Indian breeds with a view to increasing the milk supply, It must be remembered however that when Zebu or other indigenous cattle are to be used to cross with European breeds with a view to improving the milk supply in the tropics, the breeds of Zebu or indigenous cattle selected to work on must be of the best milk producing strain available.

One should not expect European breeds to produce as well in the tropics as they do in their natural environment in temperate lands. There is enough evidence to show however, that by making their environment as favourable for them as possible in the tropics, they may be expected to produce reasonably well and become a profitable investment for their owner.

REFERENCES.

(1) Wright, N., " Report on the Development of Cattle Breeding and Milk Production in Ceylon." Sessional Paper XX, 1946, Ceylon.
(2) Rice, E. B., " The Dairy Industry in Fiji." Council Paper No. 23, Government Printer, Fiji, 1949.

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HINTS TO IMPORTERS OF DAY OLD CHICKENS

BY K. J. GARNETT

The object of this article is to record the experiences and statistical information relating to the importation of 600 day old chicks by certain Indian farmers in Nadi and their subsequent development. The chicks were imported from Australia in September, 1948. These farmers have been in constant touch with officers of the Department and have closely followed methods suggested by them. It is not claimed that these methods are ideal. They were evolved with particular emphasis on simplicity so that native and Indian farmers could follow them with little chance of confusion.

Sanders(1) has emphasized that the chicks should be hatched between July and September and it is essential that preparations are made for the reception of the chicks immediately they arrive. Because of the dangers of coccidiosis it is advised that the chicks be kept off the ground for seven to eight weeks, and, in order to do this, coops as described below should be constructed. Many people have successfully raised chicks on the ground but others have lost 80 per cent more of their chickens in outbreaks of coccidiosis so that the reader is advised to take the precaution of keeping them on wire in order to avoid this disappointment.

Coops should be constructed so that they have a light wooden frame about 10 ft. long, 3 ft. wide and 18 inches high. Legs should be provided to carry the structure about 9 inches above the ground. The bottom of the coop should consist of half-inch bird netting which should be tightly stretched across the frame. This netting is usually supplied in three-foot widths so that if a second length of the wire is split down the middle, it will provide the two eighteen-inch strips required for the sides. It is also advisable to cover the top with netting on a frame which can be removed for access to the coop, but this netting can be of a coarser and less expensive mesh. The ends are best fitted with sliding wooden panels so that the chicks can be driven into the brooder at night.

The brooder is better detached from the coop as it makes the latter less cumbersome to move about into sunlight or out of the rain. Most authorities strongly advise the use of heat in brooders for at least a week. Intelligently used heating lamps are definitely beneficial, but there are such risks as fire hazard, improper ventilation and the danger of chills if the chicks are suddenly removed from a heated brooder to a cold outside temperature in the coop. Consequently alternate methods were used with very successful results in Nadi.

The brooders used were made of wood and consisted of box-like structures some 5 feet long, 3 feet wide and 15 inches high. There was a wooden floor and both sides and one end were enclosed. The other end was fitted with a sliding wooden panel similar to that used in the coop and there was a detachable wooden lid. The whole structure was carried on legs so that the floor of the brooder was the same height as the wire floor of the coop. To provide ventilation, holes about three-quarters of an inch in diameter were bored along the sides and fixed end of the brooder at intervals of four to five inches about four inches from the top. If the sliding door fits as it should, it will be seen that the whole structure is rat-proof.

The inside of the brooder is completed by making a wooden shelf about three feet square which is rested on shoulders made at the fixed end of the box so that the bottom of the shelf is about eight or nine inches above the floor. On the underside of the shelf, strips of old blanket are fitted in rows about two to two and a half inches apart. These felt strips are then cut up vertically so that the final result is rows of downward hanging felt streamers about an inch and a half wide, which reach to about a quarter of an inch of the floor of the brooder when the shelf is resting in position. At night the chicks huddle in between these strips and the warmth from their own bodies warms the space beneath the shelf. It is important that the shelf should not be

higher than the eight or nine inches stated or the space will be too large for the chicks to warm it up. The remaining two feet at the other end of the brooder is available for the chicks to wander out into if they are too hot. It will also be found that most of the chicks will be in this space in the morning when they are ready to be put out into the coop. They cool off in this space so that there is less risk of chills when they are placed out in the coop.

The shelf, complete with felt strips, should be removed each day and put in the sun. The floor of the brooder should be covered with a very thin layer of ricebran as this will prevent the droppings sticking to the wooden floor. This rice bran should be removed each day and a fresh supply added. A metal tray is sometimes used to cover a floor in order to facilitate cleaning but if this done it should still be covered with the layer of ricebran to prevent chilling.

The coop and brooder described will hold approximately 100 chicks up to two weeks old, 75 chicks three to four weeks old and 50 chicks five to seven weeks old.

The chicks should be placed in the brooder at about five in the afternoon and placed out into the coop at about seven in the morning. If it is a cold, windy morning it is advisable to remove the felted shelf and to leave the chicks in the brooder for a further hour or so. As previously mentioned, the coop should be carried out into the sun each day, but at least half the coop should be covered with a bag or coconut leaves in order that the chicks can seek shade if it is too hot. Alternatively they must be provided with a windbreak on a cold, bleak day, or kept under shelter if it is raining.

Feeding and watering are important. For the first two days the chicks should be fed on dry, crumbled, rolled oats which are best placed in flat dishes in the coop until the baby chicks have become accustomed to eating. Water should similarly be placed in shallow saucers and should be available at all times.

On the third day a start should be made with the feeding of one of the common, imported chicken mashes. This can be fed dry, but is more commonly moistened with water, or preferably, skim or buttermilk. Equal weights of the dry mash and the moistening agent will make a good friable mash in most cases.

At this stage the dishes and saucers should also be removed as the chicks will not only scratch and waste the food but also soil it badly. The ideal is a long narrow feeding trough which should be attached to the sides of the coop so that the chicks can feed from one side only and cannot get into it. A very suitable and cheap trough is made from an ordinary dry bamboo about one and a half inches in diameter. This should be cut so that the "notches" form the ends of the trough which can be as long as and include as many intermediate notches as is convenient. A small saw cut is then made across the top of the bamboo near the notches, and with the aid of a knife, a strip of the bamboo about an inch wide is removed and so the feeding trough formed.

Chicks should always have plenty of clean water available, and since they soon soil a large container it is advised that at least four drinking "fountains" be provided for each coop. These are made by filling beer bottles with clean water and fixing them in wire loops or pieces of wood with holes in them so that the bottle remains in an inverted position with its mouth about an eighth of an inch below the top of a flat tobacco tin. The water will flow from the bottle until the level of water in the tin seals off the opening, and no more will flow until the level of water in the tin is lowered by the chicks drinking and more air allowed into the bottle. In this manner the chicks are assured of a constant supply of fresh water without the inconvenience of constant attention to this detail.

The quantity to be fed and the frequency of feeding is largely dependant on the chicks and the amount of time which the owner can spare. They should receive as much as they can eat and should be fed at least four times daily in the early stages and any food remaining from a previous feed should be removed since the chicks do not relish stale food. In the first feed of the day, a dessert spoon of codliver oil should be added

to the mash to be fed to each hundred chickens. From the start they should receive liberal supplies of fresh green feed in the shape of finely chopped grass or lettuce leaves, etc.

Under no circumstances should the chicks be allowed on to the ground until they are at least seven weeks old. The reduction in the numbers from 100 to 75 per coop after two weeks and from 75 to 50 a fortnight later again should also be strictly adhered to.

The chicks should continue to receive the imported mash until they are a month old when a start can be made with the addition of small and then gradually increasing quantities of local feeds to form a mixture with the original mash until at the age of eight to ten weeks, the chicks are being fed on the cheaper local foods only. A balanced mash mainly prepared from local feeds is described in the article.

By using the methods outlined above, losses of just under 9 per cent were experienced up to the age of eight weeks when the birds were placed on the ground. These included the chicks which were dead on arrival from overseas or died soon after and several which were accidentally killed. Total losses up to the time they commenced to lay were just on 11 per cent of the 600 birds involved.

Sanders has covered adequately most points concerned with the rearing of the birds from the time they are placed on the ground until they are ready for the laying pens at the age of six months. He emphasizes the importance of teaching the birds to roost as soon as possible. In order to facilitate this, the front roost should be just off the ground and each one towards the back successively higher. Wire netting should then be tacked to the underside of the roosts and arranged so that it is impossible for the birds to get in under or behind the roosts. In the evenings, the birds which have not gone to roost should be gently driven up the "ramp" so formed, and it will be found that they will quickly adjust their habits.

Mature birds in Fiji are almost invariably run on the semi-intensive system, but there are many variations in the methods used. All too frequently, birds are crowded into a single pen which soon has the grass eaten out and becomes muddy or weed covered. Not only does this deprive the birds of a natural and important green feed, but is also unhygienic and favours the rapid multiplication of disease organisms and internal parasites. For this reason, some form of rotation is essential. Admittedly this will involve a little additional expenditure in the initial fencing costs, but contrary to popular belief, the actual area necessary per bird can be reduced if a rotation is practised.

Generally speaking there are certain limits which must be more or less adhered to and the more important of these are as follows. Each bird requires approximately 60 square feet of yard space. The house should be large enough to provide at least three square feet of floor space per bird and high enough to ensure that there is 20 cubic feet of air space for each bird. For example, a yard 80 feet square with a house of 20 feet square in the centre of it will be sufficient for 100 adult birds if the yard is divided into four equal portions running from the centre of each of the outside fences to the centre of the walls of the house.

In Nadi, a unit of 100 birds was established in a house and yards which had the above dimensions. The house was made with the weather side walled up to within a foot of the roof which was of the gable type and had a large overhang to protect this space from driving rain. These walls, which were made of plaited bamboo, continued half way along both the ends and the remainder of the ends and the other side were enclosed to a height of three feet only. All remaining space in the walls was enclosed with wire netting so that the house was fowl proof. Two doors were fitted at each end of the house, and by opening any one of these it was possible to have access to one of the corresponding four yards provided. In practice, each door is left open for a week at a time so that each yard is used for a week and then spelled for three. Nest and feed, water, etc., are situated in the house to which the birds have access at all times.

By using a yard for a week and then spelling it for three weeks before the birds are again put in it, it will be found that the fresh young shoots of grass will have a chance to develop and the grass cover in the yards will be maintained. Furthermore, most parasite eggs which are passed out in the droppings of the bird, take about a week to reach the stage where they can develop into mature worms if they are eaten by the birds, so that the birds have been moved on to the next pen before many of the larvæ have reached the infective stage, and by the time the birds are again returned to the yard, a lot of the larvæ will have died and the birds will not be subjected to such heavy risk of re-infestation.

In Nadi, both Blue grass, *Dicanthium* spp., and tropical couch, *Cynodon dactylon*, were tried and the latter found to be most suitable. On the wet side of the island, at least one farm has maintained a permanent cover with Carpet grass, *Axonopus* spp., and the use of a fortnightly rotation with two yards.

To return to the house. Roosting space of approximately ten inches is required for each bird and the roosts should be at least 16 inches apart. The roosts are best attached to a frame which is suspended about 15 or 18 inches above the floor by means of wires from the ceiling.

Many people look on concrete floors with disfavour, however they greatly facilitate cleaning of the house and are to be recommended for local conditions. As previously mentioned, the perches should be not more than 18 inches off the floor if concrete is used as this will obviate one of the objections to concrete which is the bruising of the feet of the birds if they jump down from a height.

Nests are naturally a most important part of the unit. At least one nest should be provided for every five birds in the Colony. These nests can be arranged along the wall opposite the roosts and should be approximately 14 inches wide and 16 inches deep The backs should be enclosed and the front should have a three-inch lip at the bottom to hold the straw or sand which may be used in the nest.

All feeding and watering may be done inside the house. Feed is put out into wooden troughs which may be triangular or rectangular in cross section, but whose width at the top of the actual trough is less than that of a cover which is fixed about nine inches above the trough in order to prevent the birds from fouling it. From this cover to the top of the trough, rods of plain wire are fixed perpendicularly about two and a half inches apart. This will enable the birds to poke their heads through to feed but prevent them from getting into the trough and scratching. The water trough may be similarly arranged but should be lined inside with tin.

There is a common statement that half the breeding goes down the neck in livestock. This is especially true in the case of poultry. Without good food, poor results can be expected, and it is false economy to cut expenses in this direction.

The following ration which mainly utilises local and readily available feeds has been used with considerable success. Depending on freight and local prices, the cost of the ration per 100 adult birds per month works out at approximately £6. Since feeding costs are the main recurrent items in poultry keeping and a gross return of £25 and over has been received from the Nadi flock of 96 birds over a period of some months, it will be seen that a well run poultry farm can be a profitable undertaking.

The ration used is as follows—and is sufficient for 100 to 120 adult birds per day:—

2 lb Peanut Meal.
5 lb Coconut Meal.
4 lb Rice Bran.
3 lb Pollard.
1 gal. Skim or ButterMilk (alternatively, 10 oz. Meat Meal).
1 lb Molasses (optional).
1 oz. Salt.
2 oz. Bonemeal.

Care should be taken in mixing the salt as too great a proportion in any one part of the mash will poison poultry. It is suggested that it be dissolved in the buttermilk to ensure even distribution through the mash. It is also advisable when starting with the molasses, if this is used, to mix this in with the buttermilk also and to start with only about a quarter of the molasses

mentioned and to build up gradually to the full amount over a period of several months.

The mash above should be fed in the morning.

At noon or early in the afternoon, chopped green grass should be fed.

In the evening the birds should receive cracked maize at the rate of 12 lb per 100 birds per day. If no maize is available, sorghum or padi are useful substitutes.

The following accurate costs were kept by an Indian farmer in Nadi who had a one-sixth share in the 600 birds imported by the group and reared together for the first two months. The figures, therefore, relate to 100 birds.

Cost of Chickens ..	£11	8	0 (Fiji).
Quarantine Inspection	0	8	0
Coops and Brooders (Approximate) ..	5	0	0
Feed and part time hired labour—			
September ..	5	7	1
October	4	15	7
November ..	1	14	9
December . ..	4	8	5
January	5	14	7
February . ..	5	4	3
March	5	4	10
Total ..	£49	5	6

Note that the amounts are actual expenses incurred in the month and the variation from month to month is due to a carry over of food supplies from one month to the next.

At the end of the above period there was approximately £5 worth of food in hand and the coops and brooder were still intact so that recurrent expenditure in subsequent batches of chickens will be approximately £40 per 100 up to the time they commence to lay.

Our farmer was unluckly in that inefficient labour and shortage of materials at the time necessitated excessive expenditure on the erection of the house and yards which amounted to £125 5s. 6d. and £21 10s. 6d. respectively to make a total of £148 16s. 0d. Normally, this cost could be expected to amount to approximately 100. This may sound excessive, but a well constructed building requires little further maintenance and is cheaper in the long run.

It will be seen that approximately £2 per bird was spent on the flock before laying commenced and at this stage there were 96 birds, and costs since then have been approximately £6 per month for feed.

Now for the other side of the ledger.

Exclusive of the eggs privately used, receipts from the sale of eggs amounted to—

April	£18	6	0
May	24	19	0
June	25	16	0
July	26	5	0
August	28	0	0
September ..	23	10	0
October	24	0	0
Total to date .	£170	16	0

Actual egg production per month is as follows:—

Date.	Mar. *96	Apr. 96	May. 96	June. 96	July. 96	Aug. 95	Sept. 94	Oct. 92
1	..	7	56	55	49	54	62	56
2	..	8	68	43	52	52	52	60
3	..	10	58	40	49	58	50	45
4	..	10	60	50	50	61	64	57
5	..	12	61	43	48	56	43	59
6	..	12	58	48	54	63	44	60
7	..	12	56	47	55	71	64	54
8	..	12	63	43	41	61	51	54
9	..	14	69	43	58	70	54	60
10	..	16	56	39	48	63	54	50
11	..	23	66	48	55	65	49	45
12	1	28	56	42	50	66	58	52
13	2	26	53	41	54	65	41	46
14	2	24	58	47	56	57	62	42
15	4	33	63	38	43	74	47	49
16	3	31	52	41	55	62	60	40
17	4	33	61	54	58	56	55	44
18	2	40	65	35	50	66	66	42
19	3	36	65	48	52	63	43	50
20	4	41	45	60	44	63	60	48
21	4	43	57	42	58	74	60	53
22	4	45	61	52	71	50	56	52
23	4	50	62	43	53	68	56	57
24	4	51	51	49	53	60	56	43
25	4	49	56	44	64	66	64	47
26	6	60	51	58	68	70	66	52
27	6	50	51	49	51	60	49	48
28	6	56	39	43	56	70	54	46
29	6	63	46	52	62	63	54	56
30	6	55	48	52	60	65	50	53
31	6	..	42	..	59	62	..	46
Totals ..	81	950	1,738	1,324	1,677	1,953	1,643	1,666
Average eggs per month per bird ..	0·84	9·9	18·1	13·8	17·8	20·6	17·5	18·1

* Number of birds in flock.

The slight drop in production in June was due to a neck moult which pullets are subject to in this month.

It will be seen that the birds were laying well in April, May and June when eggs are most scarce and command the best prices. It will also be seen that by the end of the year, the birds will be close to repaying the £250 which will have been spent on them in the 16 months since the venture was started. Since approximately £150 of this sum was represented in capital expenditure on the house and yards which, apart from extensions, will need little or no further expenditure for some years, a very handsome margin of profit is to be anticipated in future.

It is the intention of the farmer in Nadi to add a further 100 chickens to his flock every year. However, no more than three units of 100 birds each will be carried in any one year since the birds are to be culled at the age of 32 months by which time they will have completed their second laying season. Many people are reluctant to cull at the end of the second season so that an examination of the facts is necessary.

Given identical conditions, birds can be expected to lay approximately 30 fewer eggs in each successive year they are in production. In other words birds in their third laying season would produce approximately five dozen fewer eggs than equivalent pullets in their first year. At 3s. 6d. per dozen this represents a loss of approximately 17s. 6d. per bird. In addition, at least 10s. can be expected for the bird as a "killer," and there is the saving involved in the non-feeding of a bird through a three-month moult which would amount to nearly 4s. so that there is an overall potential saving of approximately 30s. per bird, and this is more than sufficient to replace with a young bird.

Sanders has emphasized the desirability to hatch between July and September. Chicks hatched before July tend to moult with the hens the following March or April before they have really come into production and will not then lay again until June or July. Chicks hatched after September seldom commence to lay until the end of June so that they miss out on the period between April and June when eggs are most scarce and command the best prices.

The probable cycle and suggested management in the three 100-unit flocks at Nadi is as follows:—

PEN A.	
Chicks hatched ..	August 1948
Pullets lay	March 1949
Neck moult . ..	June 1949
Full moult	April 1950
Hens lay	June–July 1950
Moult	April 1951 and should then be culled.
PEN B.	
Chick hatched ..	August 1949
Moult and culled ..	April 1952
PEN C.	
Chick hatched ..	August 1950
Moult and culled ..	April 1953

Pen A.—Chicks hatched in August 1951 are ready to go into the pens vacated by the chicks hatched in 1948 and culled in April, 1951. This cycle is then repeated in the case of Pens B and C. It will also be seen that, allowing for the rearing period, there is a period of approximately six months when a pen is empty and this enables regrassing and repairs to take place and is an invaluable spell from disease and parasite control.

REFERENCE.

(1) Sanders, R. N., "Improved Poultry Management" *Agric. Journ.* Fiji, Vol. 18, No. 4, 104.

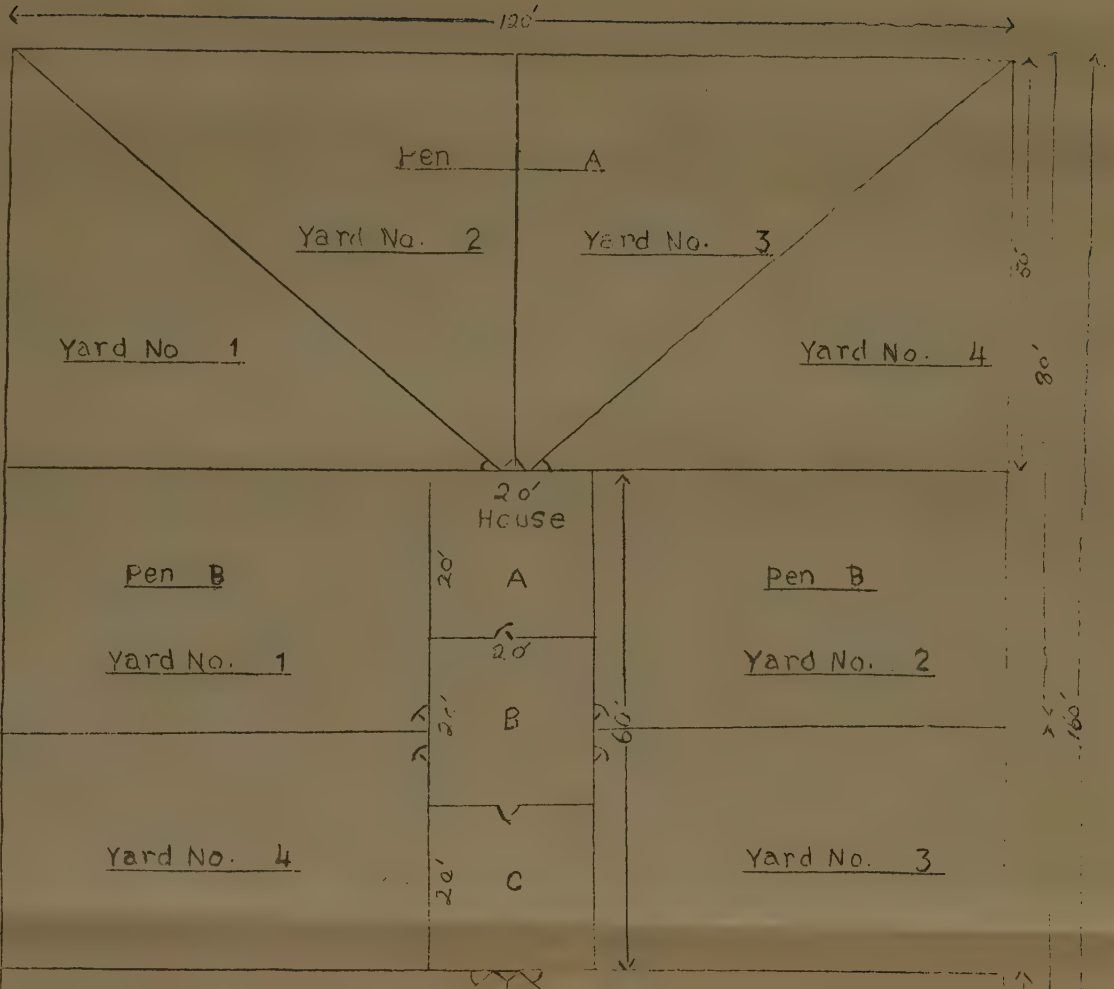
COPRA PRICES.

On 24th December, 1948, the Copra Management Committee fixed the following local buying prices for copra at Suva and Levuka, to come into effect on 1st January, 1949:

Plantation grade .	£49	10	6	per ton.
F.M.S. grade ..	£49	5	0	per ton.

COPRA TAX BILL.

As a result of the hurricane which swept through the copra producing areas of eastern islands of the Colony in December, it was decided to withdraw the Copra Tax Bill from further consideration at the Budget Session of Legislative Council.


120'
Pen A
Yard No. 2
Yard No. 3
Yard No 1
Yard No. 4
20'
80'
20'
House
Pen B
Yard No. 1
20'
A
20'
B
20'
C
Pen B
Yard No. 2
60'
Yard No. 4
Yard No. 3
160'

GHEE PRODUCTION

BY W. I. LAING

Clarified butter, or ghee, as it is usually called in Fiji, is a common constituent of the average Indian diet. The art of ghee making was brought from India many years ago, and to-day most of the ghee in this Colony is made by the traditional rather primitive method. Made in such a manner the ghee normally has a very distinctive semi-rancid odour and flavour, no doubt due to the abnormal concentration of free fatty acids. This was probably never intended, but over the years frequent use has gained popularity for this high flavoured ghee, and certain sections of the Indian public to-day appear to have marked preferences for it. On the other hand, as neither the European nor Fijian has come to know ghee at all intimately, both seem to prefer the sweet ghee which is almost identical in flavour with fresh butter.

GHEE AS AN ARTICLE OF DIET.

Ghee might well be termed "tropical butter" as it has much better keeping qualities then normal butter, and ideally can be put to almost the same range of uses. On a weight basis it contains more butterfat and less water and protein than butter. Nutritionally ordinary butter is held in high regard as a source of calories (energy) and Vitamin A, but ghee is an even better source of both these nutrients.

The absence of water and protein means that, if stored away from light (especially ultra-violet) it will keep fresh almost indefinitely, irrespective of the atmospheric temperature or humidity. Whereas butter must be kept in a refrigerator, and even then deteriorates after several months' keeping, ghee remains virtually the same as when made. As it is manufactured at the high temperature of 120° C. it is free from pathogenic organisms and does not require additional pasteurization in order to make it safe for consumers as does butter. Moreover the absence of water and protein inhibits the growth of bacteria or mould which may settle on the ghee surface.

The prejudice against the use of ghee by Europeans in the tropics is hard to explain. It is sweet, spreads well on bread and mixes with the usual types of spread. Its texture and colour are different from butter, but this does not affect the palatability to any appreciable extent. It is superior to butter for all types of baking and cooking and is undoubtedly the most nutritious and satisfactory culinary fat available in the Colony.

GHEE PRODUCTION AS A FARM ENTERPRISE.

Ideally all types of farm production should provide for the needs of the soil, the farmer and the population as a whole. Let us see how well ghee farming can fill this role.

(*a*) *The Soil.*

Good dairy husbandry, either cow or goat, not only ensures the permanence of a highly productive soil but actually enhances its fertility. "Ghee farming" being a form of dairy farming could embody all these advantages.

(*b*) *The Farmer.*

The average small holder could arrange for his dairy cows or goats to be milked twice daily. He should be able to make at least 100 lb ghee per cow milked, or 25 lb per goat milked, per annum. At government wholesale prices this would give him an annual return of £13 5s. 0d. per cow milked or £3 6s. 0d. per doe. If the carrying capacity of the land be estimated at half a cow or two goats per acre, this would mean a gross income from ghee alone of £6 12s. 6d. per acre. This should allow a reasonable margin of profit after rent, fencing and other farm maintenance charges have been deducted.

Probably more important than this is the potential use of the skim milk, if a centrifugal separator is used. The skim is definitely the most nutritious fraction of the milk and should not be wasted under any circumstances. As it contains large amounts of high quality protein it should be utilised for either human or animal nutrition. If the farmer's family and livestock cannot utilise it fully it should be sold either fresh or as curd to neighbouring poultry or

pig raisers. Even at one penny a gallon this would realize an additional 12s. 6d. per acre per annum and this is a ridiculously cheap price for any consumer who realizes its true value to pay. The possibilities of the ultimate absorption of surplus skim by a dried milk factory are also worth bearing in mind.

(*c*) *The Community.*

Everybody requires, and is entitled to an optimum level of nutrition, which presupposes a balanced food economy, the items being supplied either locally, or partly through overseas purchasing power acquired by other means. Dairy farming has a major role to play in either case. Whole milk is the best single food we have, and together with roots and cereals can supply the bulk of the Colony's food requirements. Whole milk is theoretically preferable to skim milk plus ghee, but food preferences have arisen and cannot be entirely disregarded. Skim, or dried milk can be used in a variety of ways, and ghee, as stated before, is the best culinary fat available in Fiji.

Ghee is a "home" product which can be made anywhere that milch cows or goats are run, and is not dependent, as is the butter industry, on good roads. The encouragement of ghee production should do much to alleviate the present over-all ghee-butter shortage, and from the national viewpoint should be given every encouragement.

A SIMPLE METHOD OF GHEE PRODUCTION.

Ghee has been produced at the Agricultural Station, Sigatoka, from washed cream using a method described by French.[1] It is a simple effective and economical way of making ghee and is described briefly for the benefit of those who may wish to imitate it.

(*a*) *Apparatus Required.*

	Approx. Cost
One centrifugal separator ..	£16 0 0
One large aluminium pan ..	2 0 0
One Friable stove ..	8 0 0
One thermometer (not absolutely essential) ..	0 10 0
Wooden spoons, strainer, funnel, etc.	0 10 0
Total	£27 0 0

(NOTE.—The thermometer is not absolutely essential; some sort of stove is probably already in existence in most households and the separator can possibly be replaced by setting pans).

(*b*) *Method.*

(1) Separate the milk.
(2) Add fresh, clean water to make up to half the original milk volume.
(3) Re-separate the cream-water mixture.
(4) Pour the cream into the aluminium pan and place on the stove.
(5) Stir lightly at first and more vigorously later until the "soap-sud foam" forms and rises rapidly to the top of the pan.
(6) Check the colour to see that the protein granules are slightly darker than the liquid ghee.
(7) Allow to settle, then filter into containers which may be sealed after the ghee is cold.

For those with no experience of the method described, and having no thermometer to check the temperature of the liquid, the following physical changes take place during "cooking."

(1) The butterfat melts between 30 to 40° C.
(2) The first foam forms and expands in volume up to 94° C.
(3) Simmering commence at 94° C. and the temperature remains fairly constant (94–96° C.) until all the water is boiled off.
(4) Spitting commences as the water is boiled off and the temperature rises. At this stage the liquid resembles thin custard.
(5) At about 110° C. lumpy curd forms, and large bubbles break on the surface leaving a fine protein scum.
(6) The protein particles become smaller and settle as the temperature nears 120° C. The scum disappears and the liquid has a fine amber colour.
(7) Above 120° C. the second "soap-sud foam" forms replacing the larger bubbles and when it rises rapidly the pan should be removed immediately from the fire.

(c) *Remarks.*

(1) The ghee must be thoroughly cooked or it deteriorates in quality.
(2) Sweet and sour (not stale) cream are equally suitable.
(3) Insufficient stirring leads to charring and the resultant cloudy product is tallowy, poorly grained and unpalatable.
(4) Cooking times vary from 70 to 90 minutes provided a good even hot fire is maintained. Guava makes excellent fuel.
(5) One pound of washed cream yields 7–8 ounces of ghee.

SUMMARY.

Clarified butter, or ghee is described, as an article of diet. Ghee farming is described with reference to the soil, possible returns to the farmer and the advantage to the community as a whole. A simple method of making ghee from washed cream is described and can be recommended. The total cost of new apparatus required may be as low as £2 10s. 0d. and should never be more than £27.

REFERENCE.

(1) French, M. H., 1936.—Bull. Imp. Inst., Vol. XXXIV, 32.

REORGANIZATION OF THE IMPERIAL INSTITUTE

A communique has been received from the Secretary of State for the Colonies dealing with the re-organization of the Imperial Institute. Under this re-organization the Plant and Animal Products Department has become the Colonial Products Advisory Bureau (Plant and Animal).

Founded in 1887 as a memorial of Queen Victoria's golden jubilee, the Imperial Institute has a two-fold purpose; firstly, to give scientific and technical advice in the interests of the economic development of the natural resources of the Empire, and secondly, to provide visual aids to the knowledge of the life, scenery and industries of the Empire. Early in its development the Institute passed under the control of His Majesty's Government in the United Kingdom, and has since been dependent for its maintenance on annual grants from that Government, supplemented by grants from Governments of the Empire overseas. In 1925 the Imperial Institute Act was passed nominating as the Minister responsible for the administration of the Institute, the Secretary for Overseas Trade.

As the outcome of recommendations adopted by the Commonwealth Scientific Conference of 1946 it has recently been decided by the United Kingdom Government to introduce certain changes into the constitution and purposes of the Institute. Since the Colonies stand in greater need of its scientific and technical activities than do the Dominions, these activities will in future come under the ægis of the Secretary of State for the Colonies and will be financed primarily from Colonial Development and Welfare funds. The scientific staff engaged in this work will also be taken over and it is hoped considerably to increase their numerical strength.

With the increased recognition of their value in fostering Empire knowledge, the educational functions of the Institute will be retained and emphasized. —M.C.D.

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ENTOMOLOGY . . .

THE BANANA SCAB MOTH, NACOLEIA OCTASEMA MEYR., AND ITS CONTROL

BY B. A. O'CONNOR

The banana Scab Moth, which causes considerable damage to the banana crop in Fiji, is a yellowish Pyralid moth, measuring less than one inch across the extended wings, the latter being marked with black spots. The adult moth is nocturnal in habit, and hence is rarely seen. It has been recorded from Indonesia, New Guinea, the Solomon Islands, Queensland, New Caledonia, Fiji, Samoa and Tonga.

LIFE-HISTORY AND HABITS.

The eggs are laid usually in a mass, though sometimes singly, and there may be as many as 15, or perhaps more, in a mass. The eggs are scale-like, overlapping each other, and translucent, becoming darker as the embryo develops, so that on the day when the larva is due to hatch, its black head can be seen through the chorion, or egg-shell. The site for oviposition is either the surface of the bracts enclosing the developing bunch or the upper or lower surface of the proximal half of the younger leaves. Few eggs are found on the inflorescence, most being laid on the second youngest leaf. Many more eggs are laid on the upper than on the lower surface of leaves. Twenty-five egg-masses have been counted on one plant, and no doubt more are laid on some plants. Probably between 100 and 200 eggs are commonly deposited on a plant.

Egg-laying begins shortly after the closed bunch appears, and the first eggs hatch just as the tip of the outer bract of the inflorescence is beginning to uncurl. Observations on the incubation period showed that it was six days at a time of year when the average daily mean temperature was about 75° F. Both oviposition and hatching of eggs occur at night.

The newly-emerged larvæ make their way to the top of the inflorescence, and enter at the tip of the outer bract. They move down inside the bract towards the lower portion of the bunch, and begin to feed on the surface of the second and third bracts where the latter overlap each other. Within 24 hours after hatching, they have made their way into the hands of bananas, and begin feeding on the surface of the developing fruit, quickly attacking all the hands. Thus, while the bunch is still erect, and only the first (outermost) bract has begun to open, young larvæ may be found feeding throughout the bunch.

As the bunch develops, the bracts curl back and fall off, and the fruit, which was originally closely appressed to the stem, begins to stand out. Thus there is less cover for the larvæ in the proximal hands, which are the first to be exposed, and most of the caterpillars move down to the distal hands, and some even into the upper hands of the sterile flowers. Hence the most severe damage occurs in the distal hands, as most of the larvæ grow to maturity there. Between the fingers and under the hands there is produced a mass of frass and webbing, and the caterpillars often penetrate into the fruits, and reduce many of them to hollow husks. On the proximal hands, most of the damage is superficial, due to the surface feeding of young larvæ. No precise figures have been obtained for the duration of the larval period, but it appeared to be from two to three weeks when the mean daily temperature was about 75° F.

Pupation often occurs in the damaged hands, a delicate cocoon being spun among the frass and webbing. Taylor[2] states that in Java the favoured site for pupation is under the bases of old leaves. No investigation of sites of pupation has been made by the author in Fiji. Taylor gives the figure of 9.0 to 10.5 days for the prepupal plus pupal period in Java.

CONTROL.

For many years, control measures against the moth in Fiji have consisted of dusting the hands at an early stage with a mixture of ground pyrethrum flowers and wood ashes. Dusting is carried out when the bunch has bent over, and is just beginning

to pass the horizontal position. (It cannot be done earlier, because it is difficult to remove bracts without pulling off the developing hands of fruit). The first larvæ have entered the bunch several days earlier. All the bracts are carefully removed, and dust is puffed under the hands and between the layers of fingers. The applicator used is a rubber bulb with an opening, into which is fitted a tube which may well consist of a piece of bamboo. Dust is placed in the bulb, and is propelled through the tube by squeezing the bulb.

This method of control is reasonably efficient, and produces a bunch which has surface markings on many of the fruits, but is unaffected for eating purposes. The full possibilities of the method have not been thoroughly tested, owing to the haphazard agricultural practices of the Fijian peasant farmers, by whom practically the whole of the crop is grown. Some of the bunches in a plot are dusted, others not. Hence it is reasonable to assume that the population of Scab Moths in the groves is much higher than it would be if all bunches were treated. In the latter case, it is quite possible that dusting alone would produce practically an unmarked bunch. As it is, even though a bunch is dusted, the fruits have already been marked by large numbers of caterpillars which have been inside the bunch for several days. It is of interest that, according to Simmonds,[1] other hosts of the moth are *Pandanus* and *Alpinia boas*, so that these plants would constitute a breeding-ground from which re-infestation of neighbouring banana groves could occur. Nevertheless there is no doubt that consistent dusting of all the plants in a grove would considerably improve the appearance of bunches, in addition to avoiding the heavy loss of fruit which occurs in untreated bunches.

A series of experiments has been carried out to determine whether some of the modern organic insecticides would be more efficient than pyrethrum flowers. Various dusts gave a complete kill of larvæ, and it has been decided that a DDT dust (2 per cent p-p'-isomer in talc) would be cheaper and more reliable than pyrethrum flowers. DDT also has the advantage that its residual toxicity would kill larvæ which hatched after dusting had been carried out.

A point which must be stressed concerning the dusting procedure is that it is very important to apply the dust as early as possible. A delay of even one day means a considerable increase in marking of the fruit, as the larvæ are growing rapidly,and feeding more voraciously with each successive day. If dusting is delayed two or three days, the fruit will be extensively marked.

As has been stated above, consistent dusting of every bunch in a grove would probably produce cleaner bunches. In the meantime, experiments have been carried out to find a method of control which will produce a clean bunch even in the presence of heavy populations of the Scab Moth. Some success has been achieved, though there are difficulties in implementing the method under our conditions of peasant production.

The objective aimed at was to bring the newly hatched larvæ in contact with a lethal dose of insecticide before they entered the bunch. To this end, the unopened bunch and the surrounding leaves were sprayed with various preparations. Spraying was carried out when the bracts were still very tightly wrapped around the upright bunch, and there was no sign of uncurling of the tip of the outermost bract. The leaves and bunch were examined at the same time to see that no egg-masses had already hatched. Spraying of the bunch and the few youngest leaves was then carried out by ascending a ladder leaned against the plant, and using a hand atomiser. This is a very awkward and time-consuming method, and could hardly be recommended as a routine procedure, but no more suitable spraying equipment was available.

Preliminary laboratory trials had indicated that Chlordane and DDT were the most efficient sprays, and that emulsions were superior to wettable powders. Consequently field trials were carried out with Chlordane and DDT emulsions, with and without a sticker. Chlordane 74 per cent emulsion was used in dilutions with water of from 1/40 to 1/100, and DDT 20 per cent emulsion in dilution of from 1/10 to 1/50. The more dilute solutions gave results as good as those obtained with the stronger solutions and the presence or absence of a sticker appeared immaterial. The sprays

were used at such high concentrations because they were required to leave a residue which would remain toxic for about a week, even if heavy rain should fall.

The majority of the treated bunches were later found to be perfectly clean, and numerous dead larvæ could be found inside the outermost bract. Some, however, had larvæ feeding in the hands. The clean bunches were produced under favourable weather conditions, when the deposit had dried on the sprayed surface before rain fell, and there was not a great deal of heavy rain during the following week. Considerable further experimentation is required to determine the effect of the spray during periods of continuous heavy rain. Not more than half a pint of spray fluid was used on any plant, so that, using DDT emulsion, the cost of spray materials was less than a half-penny per plant.

Later experiments in the application of DDT 20 per cent emulsion, at a dilution of 1/50, using a knapsack sprayer with a six foot extension pipe, have shown that excellent control can be obtained. This was so even when the spray was applied to wet foliage during drizzling rain, with heavy falls of rain during the subsequent 24 hours. However, when the same strength of spray was applied during periods of hot, sunny weather, several bunches fell off within a few days of spraying, apparently due to burning by the spray fluid. Subsequently, a spray of DDT 20 per cent emulsion at a dilution of 1/250 proved quite successful when applied on a hot, sunny day, and had no ill effect on the bunch. There was no rain for 24 hours after spraying, but during the next two days 228 points of rain fell. About one pint of spray fluid was used per plant. Spraying experiments are being continued.

As mentioned above, a hand atomiser is quite unsuitable for spraying banana plants, particularly as many of the plants in village groves are liable to fall over if one ascends a ladder leaning against them. A suitable applicator would be a knapsack sprayer fitted with an extension lance, but the cost of such a machine would limit its use by farmers. It is considered that the ideal applicator would be a pneumatic sprayer of small capacity, with a trigger release, a bracket into which could be fitted a light pole, and an adjustable or downwardly directed nozzle. Such a machine could be held above the plant, and the spray fluid released by pulling a string attached to the trigger. A sprayer of this type is illustrated in the catalogue of an Australian manufacturer, but unfortunately is not at present in production.

It is not thought that early spraying of the unopened bunch could entirely replace dusting, the reasons being—

(*a*) it is difficult to be certain of spraying every bunch before some of the larvæ have hatched;

(*b*) heavy and continuous rain may wash off most of the spray deposit before all larvæ have hatched;

(*c*) if spraying is not very thoroughly done, with good coverage of leaves and bunch, larvæ may be able to enter the bunch unharmed.

Hence, to obtain a high proportion of very clean bunches under our present conditions of big populations of Scab Moth, it would be necessary to spray the bunch before the outer bract has begun to unfold, and also to dust the hands when the bunch reaches the horizontal position. Such a procedure would undoubtedly produce much cleaner bunches than are harvested at present.

A third method of control which has been considered, but which is thought to be impracticable, is the destruction of egg masses before they hatch. It is extremely difficult to find all the eggs, some may be deposited after the plant has been inspected, and efforts to reach the egg-masses often lead to the breaking off of leaves.

REFERENCES.

(1) Simmonds, H. W.—"Entomology Division—Annual Report, 1935. Ann. Bull, Div. Repts., Dept. Agric., Fiji, 1935, p. 19.

(2) Taylor, T. H. C.—"An Investigation of the Banana-Scab Moth . . . in Java . . . ," Fiji *Agric. Jour.*, Vol. 6, No. 1, p. 5.

INSECTICIDES

BY B. A. O'CONNOR

Some very satisfactory results have been achieved in tests of some of the more modern insecticides against local insect pests. Following are notes on various formulations.

DDT Water Dispersible Powder (50 *per cent p-p'isomer*).—This is considered to be a very useful general purpose insecticide. For treatment of agricultural pests, one pound of the powder is mixed with ten gallons of water, the mixture being applied as a spray. For residual treatment of barns, stables and houses, one pound of powder is mixed with one gallon of water, and sprayed liberally on the surfaces to be treated. This leaves a deposit which remains lethal to flies and mosquitoes for several months, and helps to control other pests, such as ticks, cockroaches, ants and fleas. As the powder is merely suspended in the water, the spray mixture should be shaken up occasionally during use, to prevent settling of the powder.

DDT Dust.—This is commonly manufactured with a 2 per cent or 10 per cent content of the p-p'isomer of DDT. The 2 per cent dust is generally satisfactory for control of a wide range of agricultural pests, though 1 per cent suffices for many pests. Dusts may be broken down to the required strength by the addition of pyrophyllite. The dust is applied lightly to plants by shaking through a fine muslin bag, using a small bellows or dust gun (methods suitable for the gardener) or by using a rotary or knapsack dusting machine. The best time to apply the dust is early in the morning, when there is usually little wind, and the foliage is wet with dew, However. if the pest concerned feeds only at night, it may be advisable to dust the plants in the evening, when it appears that rain is not imminent, otherwise the deposit may be washed off by heavy rain before it is contacted by the insect.

DDT sprays and dusts have been tried against a variety of local insect pests. A spray consisting of 1 lb of 50 per cent Dispersible Powder in 50 gallons of water gave complete control of the Rice Leafhopper, *Sogata furcifera*, when applied at weekly intervals. It also gave an excellent kill of the Taro Leafhopper, *Tarophagus proserpina*. The management of the Crown Estates in Samoa was advised to use this spray against the Rose Beetle, *Adoretus versutus*, which was defoliating young cacao trees, and they reported excellent protection against the pest. The Dispersible Powder was also tried locally in laboratory experiments, for making up baits to control the armyworms, *Cirphis unipuncta*. It was found that the powder used at the rate of ½ lb in 25 lb of bait, gave results as good as, or better than the standard 1 lb of Paris Green in the same quantity of bait. Confirmatory field trials are necessary, but it is hoped that it may be possible to replace the highly toxic Paris Green with DDT.

DDT dust (25 per cent) gave excellent control of a severe infestation of the Taro Leafhopper, killing not only the insects present at the time of dusting, but also the nymphs which emerged from the egg during the following week, even though rain fell during this period. The larvæ of the Scab Moth, *Nacoleia octasema*, suffered 100 per cent mortality when 2 per cent dust was used instead of pyrethrum for puff-dusting young bunches. DDT is much cheaper than pyrethrum for this purpose. Other pests controlled by using DDT dust (1 per cent) were cabbage grubs—chiefly *Prodenia litura*—and the beet webworm, *Hymenia recurvalis*.

Chlordane 74 per cent Emulsifiable Concentrate.—This product, being manufactured in United States of America, is not readily available, but is mentioned because it appears to be outstandingly successful in control of ants, besides being effective against a wide range of other pests of the household and the field. Chlordane gives a somewhat quicker kill than DDT, though it is not so persistent. It is said to have a fumigating as well as a contact action.

For control of ants in soil, it is recommended that from one to two pounds of actual chlordane be applied per acre. Locally it has been found that a complete kill of ground-nesting ants can be obtained

by applying to the nests a solution of one part by volume of chlordane emulsion to 1,000 parts of water, using a watering can. Very likely lower concentrations would be successful. Chlordane seems to have considerable residual effect in the soil, and is lethal to a variety of soil pests. It is also effective against ants and cockroaches in the house, being definitely superior in this respect to DDT.

SCALE INSECTS OF FIJI

By B. A. O'CONNOR

Lever,(2) in 1945, published a list of the scale insects and mealybugs of Fiji. Since then, further species have been found, namely *Parlatoria crotonis* Douglas from leaves of Croton and Ivi (*Inocarpus edulis*,) *Parlatoria proteus* Curtis from leaves of citrus, *Selanaspidus articulatus* Morgan from leaves of citrus and other hosts, *Ischnaspis longirostris* Signoret on the leaves of a privet hedge, and on a species of palm, and *Trionymus sacchari* Cockerell on sugar cane.

Dr. V. P. Rao(3) has recently shown that *Dinaspis veitchi* Green and Laing is a synonym of *Unaspis citri* Comstock. *D. veitchi* was originally described from Fiji. Ferris(1) lists *Aspidiotus cocotis* Newstead as a synonym of *Aspidiotus destructor* Signoret.

A request to Dr. W. J. Hall, Director of the Commonwealth Bureau of Entomology, for information regarding the status of the specific names *Aspidiotus simmondsi* Green and Laing and *Aspidiotus suvaensis* Green has elicited the following information:—Each of the names is a *nomen nudum*, both being only manuscript names. *A. simmondsi* is an unpublished synonym of *A. pangoensis* Doane and Ferris.

Though the California Red Scale, *Aonidiella aurantii* Maskell, was recorded in 1921 from Fiji, as pointed out by Lever, there seems to have been no subsequent record of its occurrence. A careful inspection of citrus trees on the main island of Viti Levu has failed to reveal its presence.

REFERENCES.

(1) Ferris, G. F.—"The Genus Aspidiotus," Microentomology, Vol. 6 Pt. 2, 1941.
(2) Lever, R. J. A. W.—"An Annotated Check List of the Mealy Bugs and Scale Insects of Fiji." Fiji *Agric. Jour.*, Vol. 16, No. 2. p. 41, 1945.
(3) Rao, V. Prabhaker—"The Genus Unanpis MacGillivray." Microentomology, Vol, 14.Pt. 2, 1949.

A SELECTIVE INSECTIVOROUS PLANT

By H. W. SIMMONDS

On a recent visit to Lautoka I was interested in the movements of a small Lycænid butterfly, which was hovering round the unopened buds of a white plumbago. As it was not a species which I expected to breed on this plant, I picked the head and examined it. I then found that the sepals forming the calyx carried numerous bristles, each terminating in a minute drop of clear viscid liquid. This had proved a trap for numbers of small insects, most numerous of which were the parasitic groups of Braconids and Chalcids, with a few small bugs and flies. The Braconids far outnumbered all the others combined, with the Chalcids coming next.

I am informed that the plant has been established for many years without increasing to any great extent, but it was definitely acting as a selective trap to the two groups, the first of which are normally primary parasites upon caterpillars, whilst the second may be either primary or secondary parasites of the same hosts.

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VETERINARY . . .

DISEASES OF ANIMALS RECORDED IN FIJI

BY C. R. TURBET

CATTLE.

Disease.	*Incidence.*
Tuberculosis	Widespread and heavy.
Actinomycosis	Common.
Contagious abortion	Common.
Mastitis—	
Staphylococcus	Most common.
Bact. pyogenes	Few cases.
Bact. coli	Few cases.
Streptococcus	Not common.
Foot-rot	Common in wet season.
Cancer—	
Sunburn cancer	Common.
Epithelioma of eye	Common.
Poisoning by Lantana (Dermatitis)	Common.
Tetanus	Few cases annually.
Botulism	Rare in cattle.
Malignant oedema	Rare in cattle.
Pneumonia of calves	Common.
Calf dysentery	Common.
White scour	Common.
Verminous bronchitis	Common.
Helminthiasis	Common.
Hæmonchiasis	Common.
Oesophagostomiasis	Common.
Paramphistomiasis	Common.
Cow pox	Uncommon.
Sterility (physiological)	Associated with abortion.
Infectious Keratitis	Epizootic in occurrence.
Malnutrition	Common.
Osteomalacia	Uncommon.
Hæmorrhagic septicæmia	Rare.
Bovine lymphangitis	One case.
Coccidiosis	Rare.
Generalized Dermatomycosis (ringworm)	Common.

HORSES.

Disease.	*Incidence.*
Osteoporosis	Localized areas.
Sporotrichosis (Fiji sores)	Decreasing incidence.
Generalized Dermatomycosis (ringworm)	Common.
Tetanus	Few cases annually.
Strangles	Occurs in recently imported horses only.
Epithelioma	Uncommon.
Gastrophilus nasalis	Common.

Strongylosis	Commonest and most important disease of horses.
Oxyuriasis	Common.
Alopecia (Leucæna glauca poisoning)	Occurs where the plant occurs.
Jointill Ulcerative lymphangitis	Has not occurred since 1913.

SHEEP AND GOATS.

Disease.	*Incidence.*
Footrot	Common.
Infectious Keratitis	Common.
Dermatomycosis	Formerly common in sheep.
Worm infestation	Common and widespread.
Blowfly infection	Formerly common in sheep.
Oestrus ovis	Imported sheep only.
Malnutrition	Common.
Caseous lymphadenitis	Formerly found in sheep.
Unidentified diseases	Early records.

PIGS.

Tuberculosis	Common.
Polyarthritis	Uncommon.
Stephanuriasis (Kidney worm disease)	Common and widespread among uncontrolled pigs.
Hookworm disease	Common and widespread among uncontrolled pigs. Rare in modern sties.
Verminous bronchitis	
Other worm parasites	
Paratyphoid	.....
Malnutrition	.....
Rickets and Posterior paralysis	.....
Mastitis	.....
Rheumatism	Common under certain conditions.
Demodectic mange	.....
Sarcoptic mange	.....
Dermatitis (sunburn)	.....

DOGS AND CATS.

Disease.	*Incidence.*
Distemper of Dogs	.....
Distemper of Cats (infectious enteritis)	.....
Demodectic mange	Uncommon.
Sarcoptic mange	Rare.
Dermatomycosis (Generalized ringworm)	Widespread and common.
Ear mange	.....
Ear canker (mycotic)	Common.
Stuttgart disease (Jaundice)	Rare.
Grass seed abscess in cats	Common.
Tuberculosis	Rare.
Ancylostomiasis	Common.
Filariasis of dogs (Heartworm disease)	Widespread and common.
Botulism	One case only.

POULTRY.

Disease.	*Incidence.*
Fowl Typhoid	Epizootic.
Fowl pox	Enzootic.
Contagious Bronchitis (laryngotracheitis) .	Epizootic.
Eye roup (coryza)	Enzootic and epizootic.
Botulisim	Widespread when epizootic.
Coccidiosis	Common.
Dermatomycosis (fungus infection of feathers).	Common.
Favus	Rare.
Leg mange	Common.
Depluming mange	Common.
Ectoparasites	Common.
Air sack mite disease	Uncommon.
Bacillary white Diarrhœa (Pullorum disease).	Not now occurring.
Infectious enterohepatitis of turkeys ..	Uncommon.
Neurolymphamatosis (Fowl paralysis) ..	Enzootic and widespread.
Newcastle disease	Epizootic not now occurring.

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INTERNAL PARASITES OF ANIMALS RECORDED IN FIJI

BY C. R. TURBET

Animal.	Parasite.	Intermed. Host.	Locality.	Recorded	Date.
Horses ..	Round Worms—				
	Ascaris megalocephala	.....	Suva ..	C. R. Turbet .	1940
	Ozyurus equi	.....	Widespread	,,	1930
	Strongylus armatus	.....	,,	,,	1930
	Strongylus vulgaris	.....	,,	,,	1930
	Strongylus edentatus	.....	,,	,,	1930
	Trichonema spp.	.....	,,	,,	1930
	Tape Worms—				
	Anaphlocephala sp.	Unknown	Nadi ..	,,	1930
	Bots—Gastrophilus nasalis	Bot fly	Widespread	,,	1930
Cattle ..	Round Worms—				
	Hæmonchus contortus	.....	,,	,,	1930
	Oesophagostomum radiatum ..	.....	,,	,,	1923
	Oesophagostomum columbianum .	.....	,,	W. R. Rainey	1914
	Trichuris ovis.	.....	,,	C. R. Turbet .	1930
	Ascaris vitulorum	.....	Suva ..	,,	1930
	Ascaris lumbricoides	.....	,,	,,	1939
	Setaria labiato-papillosa	.....	,,	,,	1930
	Dictyocaulus viviparous	.....	,,	,,	1930
	Bunostomum phlebotomum ..	.....	Tailevu ..	,,	1931
	Bunostomum phlebotomum ..	.....	Vatia Point	R. N. Sanders	1944
	Cooperia punctata	.....	,,	,,	1944
	Onchoceria gibsoni	.....	Yagara ..	,,	1942
	Trichostrongylus spp.	.....	,,	,,	1942
	Strongyloides papillosus	.....	,,	,,	1942.
	Tape Worms..	.....	....	....	..
	Flukes—Paramphistomum cervi (Cotylophorum cotylophora) ?	Bond Snails . ..	Widespread	C. R. Turbet .	1923
Sheep and Goats ..	Round Worms—				
	Hæmonchus contortus	.....	Tavua ..	C. R. Turbet .	1930
	Ostentagia circumcincta	.....	,,	,,	..
	Trichuris ovis	.....	,,	,,	..
	Strongyloides papillosus	.....	,,	,,	..
	Oesophagostomum columbianum .	.....	,,	,,	..
	Tape Worms—Moniezia expansa ..	Unknown	Tavua and Taveuni.	,,	1930
	Bots—Oestrus ovis	Imported sheep only	Suva ..	,,	1930
Pigs ..	Round Worms—				
	Ostertagia rubida	.....	Suva ..	C. R. Turbet .	1932
	Gnathostomum hispidum	.....	,,	,,	1923
	Crassiosoma urosubulatum . ..	.....	,,	,,	1923
	Oesophagostomum sp.	.....	,,	,,	1923
	Stephanurus dentatus	.....	,,	,,	1923
	Metastrongylus apri	.....	,,	,,	1923
	Trichuris suis	.....	,,	,,	1923
	Ascaris lumbricoides	.....	,,	,,	1923
Dogs and Cats ..	Round Worms—				
	Ascaris canis	.....	,,	,,	1923
	Ascaris mystax	.....	....	....	..
	Dirofilaria immitis	Mosquito	Widespread	Early record..	..
	Ancylostomum braziliense . ..	.....	Suva ..	C. R. Turbet .	1923
	Ancylostomum caninum	.....	,,	,,	1923
	Trichuris vulpis	.....	,,	K. J. Garnett.	1949
	Tape Worms—Dipylidium caninum .	Flea	Widespread	C. R. Turbet .	1923
Poultry ..	Round Worms—				
	Heterakis perspiellum	.....	Suva ..	,,	1923
	Heterakis papillosa	.....	,,	,,	1923
	Dispharagus nasutus	.....	,,	,,	1923
	Syngamus trachealis	.....	,,	,,	1923
	Trichuris spp.	.....	,,	,,	1923
	Oxyspirua mansoni	Cockroach	,,	Manson Bahr	1914
	Tape Worm—				
	Choantænia infundibuliformis ..	.....	,,	C. R. Turbet .	1923

PERSONAL NOTES

Mr. R. Johns, formerly Agricultural Officer, Fiji and British Solomon Islands Protectorate, has recently been appointed Regional Deputy Director of Agriculture, Nigeria.

Laboratory Assistant, Filiwe Lewanavanua, was awarded the British Empire Medal in the New Year Honours List. The award is in recognition of his long and efficient service in the Entomological Laboratory of the Department of Agriculture.

Under the United Kingdom Government's Colonial Development and Welfare Scholarship scheme to enable people of the Colonies to fit themselves for appointment to the higher grade of Government Service, it was announced in March that eight scholarships had been awarded to young men and women from Fiji.

Amongst these are Mr. R. Nigel Coster, who is completing the Bachelor of Agricultural Science degree course at Canterbury Agricultural College, New Zealand, and Mr. J. W. Parham, Laboratory Assistant, Department of Agriculture, who is taking a B.Sc. degree course at Auckland University College.

PRODUCE (IMPORTS AND EXPORTS) FOR THREE MONTHS ENDING 30TH JUNE, 1949

	Quantity	New Zealand		Australia		Other Countries		Total Value	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
IMPORTS.	lb	£F	£F	£F	£F	£F	£F	£F	£F
Fresh Fruit—									
New Zealand ..	93,416	2,569	....	....	....	....	....	2,569	....
Australia	41,843	....	....	1,327	....	....	....	1,327	....
Garlic—									
New Zealand ..	59,852	2,285	....	284	....	....	....	2,285	....
Australia	7,817	....	....	284	..	....	....	284	....
Onions—									
New Zealand ..	532,649	5,730	....	248	....	....	....	5,730	....
Australia	22,646	....	....	248	....	....	....	248	....
Potatoes—									
New Zealand ..	1,103,917	10,592	....	....	....	....	....	10,592	....
Australia	128,576	....	....	1,594	....	....	....	1,594	....
Mixed Vegetables—									
New Zealand ..	63,031	1,385	....	....	....	....	....	1,385	....
Australia	8,024	....	....	138	....	....	....	138	....
U.S.A.	22	....	....	....	....	9	....	9	....
Spices—									
Australia	10,298	....	....	711	....	....	....	711	....
India	35,354	....	....	....	....	1,935	....	1,935	....
Malaya	129	....	....	....	....	55	....	55	....
Ceylon	230	....	....	....	....	13	....	13	....
Zanzibar	175	....	....	....	....	12	....	12	....
China	42	....	....	....	....	22	....	22	....
United Kingdom ..	108	....	....	....	....	35	....	35	....
British East Indies	168	....	....	....	....	78	....	78	....
Hong Kong . ..	92	....	....	....	....	82	....	82	....
British West Indies	280	....	....	....	....	30	....	30	....

PRODUCE (IMPORTS AND EXPORTS) FOR THREE MONTHS ENDING 30TH JUNE, 1949—(*contd.*)

	Quantity	New Zealand		Australia		Other Countries		Total Value	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
EXPORTS.	lb	£F	£F	£F	£F	£F	£F	£F	£F
Bananas—									
New Zealand ..	3,745,440	....	30,547	....	....	....	....	....	30,547
Australia	180	....	....	....	1	....	....	....	1
Canada	40,589	....	....	....	....	....	539	....	539
Ocean Island ..	2,430	....	....	....	....	....	20	....	20
Pineapples—									
New Zealand ..	60	....	1	....	....	....	....	....	1
Mixed Fruit—									
New Zealand ..	6,360	....	80	....	....	....	....	....	80
Peanuts (in shell)—									
New Zealand ..	115,500	....	2,850	....	....	....	....	....	2,850
Samoa	6,600	....	....	....	....	....	220	....	220
Samoa	6,600	....	....	....	....	....	220	....	220
Green Ginger—									
New Zealand ..	102,250	....	1,704	....	....	....	....	....	1,704
Arrowroot—									
New Zealand ..	2,080	....	65	....	....	....	....	....	65
Taro (Dalo)—									
New Zealand ..	11,200	....	63	....	....	....	....	....	63
Ocean Island ..	160	....	....	....	....	....	1	....	1
Avocado Pears—									
New Zealand ..	150	....	4	....	....	....	....	....	4
Yams—									
New Zealand ..	560	....	4	....	....	....	....	....	4
Ocean Island ..	160	....	....	....	....	....	1	....	1
Pawpaws—									
New Zealand ..	40	....	1	....	....	....	....	....	1
Grape Fruit—									
New Zealand ..	15,960	....	213	....	....	....	....	....	213
Oranges—									
New Zealand ..	129,540	....	1,620	....	....	....	....	....	1,620
Mandarins—									
New Zealand ..	64,320	....	804	....	....	....	....	....	804
Mixed Vegetable—									
New Zealand ..	2,560	....	24	....	....	....	....	....	24
Coconuts—									
New Zealand ..	100	....	1	....	....	....	....	....	1
Rice Bran—									
New Zealand ..	60,300	....	335	....	....	....	....	....	335
Coconut Meal—									
New Zealand ..	1,760,400	....	11,440	....	....	....	....	....	11,440
United Kingdom ..	450,000	....	....	....	....	....	2,925	....	2,925
Total	....	£22,561	£49,756	£4,302	£1	£2,271	£3,706	£29,134	£53,463

The following commodities are not included: Flour, Sharps, Rice, Sugar, Copra and Coconut Oil.

R. A. KABLE,
Produce Inspector.

SCIENCE AND KEEPING QUALITIES OF FISH

Extract from Overseas Press Services, Central Office of Information, London.

The fishing industry in Britain has always been of the greatest importance both for satisfying her own needs and for supplying other countries. Today when meat is so scarce, its importance is greater than ever. Every year about one million tons of fish are landed but even so an expansion of the industry is urgent. Despite the paramount need for even greater quantities, the question of quality is now the subject of close scientific investigation. As a result, big improvements are expected in the near future.

An important centre of research for the fishing industry in Britain is the Torry Research Station at Aberdeen—a Government institution. There a great deal of information has been accumulated about various factors which cause fish to become stale and unpalatable. The importance of this research needs no emphasis for under modern conditions fishermen have to go far afield and their time and labour are wasted unless they can deliver their catches to the consumer in first-class condition. Years ago popular taste was satisfied with relatively crude methods of preservation such as salting, drying or heavily smoking, but to-day the demand is for fish as identical as possible with the freshly caught article or for fish whose natural flavour is not altogether masked by the curing process.

One of the chief causes of decay is bacteria. Skin and gills of fish normally swarm with various species of bacteria but as long as the fish is alive they are kept within bounds. As soon as the fish dies they begin to multiply exceedingly, and by their activities cause staleness, and, finally, putrefaction. Experiments have shown that the growth of these bacteria depends very much on temperature but that merely lowering the temperature is not always a remedy. Thus sometimes the bacteria grow more profusely at—3°C. than at 37°C. (blood heat). Every degree counts and as a rule the best result is obtained by chilling fish as quickly and thoroughly as possible without actually freezing it. In this way the onset of bacterial decay can be delayed for four or five days. Once chilled, they must be kept chilled so as to stifle the activities of bacteria. Various experiments are being made to improve on the present methods of chilling of freshly caught fish in ice-cold seawater; improved insulation of fish holds and better temperature control during unloading, filleting and transport.

The bacteria which cause decay are also sensitive to acidity of flesh of fish after death. Under ordinary conditions this varies quite a lot from one type of fish to another and is an important reason for well-known differences in their keeping qualities. Halibut, for example, keeps much better than cod or haddock because after death its flesh becomes quite strongly acid. It has been discovered that the less a fish struggles when caught, the more acid it becomes and the better it keeps, but unfortunately there is at present no way of turning this discovery to practical advantage. Fish caught in nets or on lines usually struggle violently as they are brought aboard and are unimpressed by the argument that they would make better food if they quietly resigned themselves to their fate.

Scientists describe the methods now used for testing the freshness of fish by a rather high-sounding word " organoleptic ". This implies nothing more than refinement of the ordinary housewife's test of judging fish by its appearance, feel and above all smell. Although the organoleptic test is now universally used and with practice can be fairly consistent, its result is liable to depend to a great extent on the person who makes it. Consequently a search is being made for a reliable test which will give the same result whoever makes it and wherever it is made. For this the help of chemists has been enlisted and they have made a detailed study of the chemical changes which occur in fish after death.

At Torry Research Station it has been found that in cod and related fish a substance called dimethylamine begins to form immediately after death. This has a fishy and unpleasant smell. Another related substance—trimethylamine oxide—is also formed and becomes converted into trimethylamine. The production of trimethylamine—which also has a fishy smell—closely parallels the growth of putrefying bacteria and is therefore a useful measure of freshness. During the war, measurement of the quantity of trimethylamine in cod fillets imported into Britain was used as an indication of their freshness. For some kinds of fish measurement of dimethylamine can now be used for the same purpose and is especially useful in the earliest stages of spoilage as it appears before trimethylamine.

Other substances which have been identified as unpleasant products of decay are indole, sulphuretted hydrogen (which gives rotten eggs their smell), and fatty acids similar to those found in rancid butter.

Increased cleanliness in handling and storing fish has been found to prolong the freshness of fish for several days, chiefly as a result of reducing contamination with bacteria of decay. A special group of workers is to study the practical side of the problem and see how far the methods now in general use can economically be improved.

Herrings, which offer the biggest opportunity for increased catches, present a special problem. Even under the best conditions of chilling they keep fresh for only three or four days. As they are now usually caught only a few hours' journey from mainland ports this is not a serious matter but it makes it impossible to distribute in good condition heavy catches that could be made in remoter waters. For these the best solution seems to be speedy freezing or canning at factories at ports near the fishing grounds or even on specially fitted ships.

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